



## Effectiveness of Fogging Actions, Cleaning with Chlorine, Cleaning with Ammonium Chloride in Reducing the Numbers Of Germs In Isolated And Non-Isolated Room Of Gadjah Mada University Academic Hospital Yogyakarta

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### ABSTRACT

**Background:** In developing countries including Indonesia, the prevalence of infection transmission increased by 40%. There are several areas of patient care that are at risk of being a breeding ground for microorganisms: walls, curtains room and bed patient. Cleaning must be done at least once a month using aerosol.

**Objectives:** This study was aimed to determine the ratio of the number of room germs with 3 treatments: fogging, cleaning the room using chlorin and ammonium chloride.

**Design:** This research is an experimental research. The sampling method of this research used purposive sampling technique. The research location is at Inpatient Installation of Universitas Gadjah Mada Academic Hospital. Data obtained from the results of the sample examination were analyzed descriptively.

**Results:** Cleaning using chlorine does not meet the standards for air testing in isolated space, whereas the use of chlorin in non-isolated space meets the requirements of Quality Standard. The results of wiping floors and walls both in the isolated room and the non-isolated one meet the requirements of the Quality Standard. The number of air, floor, and wall germs in isolated room and non-isolated room after fogging meet the requirement of Quality Standard, and the number of air, floor, and wall germs in isolation and non-insulation after ammonium chloride-cleaning meets the requirement of Quality Standard in accordance with Ministry of Health Decree 1204 / SK / X / 2004 About Environmental Health

**Conclusion:** Based on the results, fogging and cleaning with Ammonium Chloride is effective in reducing the number of airborne germs in the isolated space (within the range of quality standards). Meanwhile, fogging with ammonium chloride and chlorine obtained the same results in reducing the number of germs on the floor and the walls of isolated and non-isolated rooms.

**KEYWORDS:** Ammonium chloride, Chlorine, Fogging, Number of room germs.

### 1. Introduction

Developing countries, including Indonesia, the prevalence of infection transmission has increased by 40% (Workshop on Instrument Sterilization, dr. Sardjito Hospital, Yogyakarta, 2017). According to Minister of Health Decree 1204/SK/X/2004 regarding Environmental Health Requirements in Hospital states that cleaning must be done at least once a month using aerosols<sup>1</sup>. Floor is the area with the highest content of microorganisms (MRSA 55%, C. Difficile 48%)<sup>2</sup>. In addition, there are some patient care areas that has the risk of becoming a breeding ground for microorganisms, i.e: walls, curtains, and patient bed.

As mentioned in Ministry of Health Decree 1204/SK/X/2004 about Environmental Health Requirements in Hospital, cleaning must be done at least once per month using an aerosol.

Meanwhile, Indonesian Society of Infection Control said that aerosol and fogging must be avoided when cleaning the patient care room<sup>3</sup>. Room's disinfection is an effort to suppress or reduce the number of germs (microorganisms) on the room's air, walls, floors, and other objects in the room. One of the methods used in the room's disinfection is fogging. Fogging is one of the sterilization methods in Patient Care Room that is considered effective for reducing the number of microorganisms in the room. Room cleaning using Chlorine 0,05% and 0,5% is also a recommended method. Currently, people start not using chlorine<sup>4</sup>, because of its corrosive property so they switch to disinfectants which are derivatives of chlorine suggested by CDC<sup>5</sup>.

This research aimed to compare the number of germs in the room after fogging, room cleaning using chlorine, and room cleaning

with chlorine's derivatives. Besides, it also aimed to compare the number of germs in the isolated room and the unisolated one.

## 2. Methods

This is an experimental research where would be done in patient hospitalized rooms of Universitas Gadjah Mada Academic Hospital. It consists of:

- Isolated room: Nakula 4 patient hospitalized room.
- Unisolated room: Gatotkaca 3 patient hospitalized room (303 room with 1 patient)

Before the research was conducted, the walls of the rooms are painted with waterproof agent as a preparatory step. This is done because the wall paint used at this time will leave a residual blackish color and become thinner when using chlorine for the cleaning process.

## 3. Results and Discussions

Nakula 4 which supposed to be this research's location, can't be used because it coincides with the construction of Bima 3 as a substitute for the Nakula 4 Inpatient Room. So this research conducted in Bima 3 Room 307, Gatotkaca 3 Room 303, and Gatotkaca 4 Room 403. The researchers measured the room's width and the result was:

- Room 307 of Bima 3 hospitalized patient room (Isolated room). The width of the room is 23,5 m<sup>2</sup>
- Room 303 of Gatotkaca 3 hospitalized patient room (Unisolated room). The width of the room is 23,5 m<sup>2</sup>
- Room 403 of Gatotkaca 4 hospitalized patient room (Unisolated room). The width of the room is 35 m<sup>2</sup>

The researcher tested the air velocity of Bima 3 Room 307 as the isolated room and found that the air velocity was <12 ACH (The air velocity's standard in isolated room should be more than 12 ACH). So it can be concluded that Bima 3 Room 307 does not meet the requirement as a negative pressured isolation room.

This research conducted on 3 steps, they were step 1 (Cleaning room using chlorine), step 2 (Cleaning using fogging), and Step 3 (Cleaning using Ammonium Chloride).

- Step 1 (Cleaning room using Chlorine)  
This step was conducted on 24th August, 2017. Because there are some patients in Gatotkaca 3, this study was only conducted in Bima 3 Isolated Room and Gatotkaca 4 Non-isolated room where had the same condition as Gatotkaca 3. The researchers clean the Bima 3 and Gatotkaca 4 using chlorine 0,5% in patient critical area, and 0,05% in . The results of this step are presented on Table 1.

**Table 1.** Number of Germs after Cleaning with Chlorin using IKM/5.4.6.M/BLK Method

Kind of sample/ Sample code	Location	Germ's Number	
		Result	Standard
Air / 020596	Bima 3 - 307	340 cfu/m <sup>3</sup>	200 cfu/m <sup>3</sup>
Floor / 020597	Bima 3 - 307	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>
Wall / 020598	Bima 3 - 307	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>
Air / 023777	Gatotkaca 4 - 403	340 cfu/m <sup>3</sup>	200 - 500 cfu/m <sup>3</sup>
Floor / 023778	Gatotkaca 4 - 403	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>
Wall / 020601	Gatotkaca 4 - 403	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>

Table 1 shows that after cleaning with chlorine, the number of germs in the air is the highest amongs all. Gatotkaca 4-403 non isolated room has 340 cfu/m<sup>3</sup> germs on it's air. It meets the standar of germ's number on non-isolated room, which is 200-500 cfu/m<sup>3</sup>. Meanwhile the air of Bima 3-307 isolated room has as much as 340 cfu/m<sup>3</sup> germs. It means Bima 3-307 didn't meet the requirements of isolated room's germ number, which is 200 cfu/m<sup>3</sup>. The germ's number

on the walls and floors of Gatotkaca 4-403 isolated room and Bima 3-307 non isolated room were 0-1cfu/cm<sup>2</sup> for all, so it meets the Quality Standards Requirements of Kepmenkes 1204/MenKes/SK/X/2004 about Environmental Health Requirements in Hospital.

- Step 2 (Cleaning using fogging)  
This step was conducted on 26th Sepetember 2017. It was located in Bima 3-307 isolated room and Gatotkaca 3-303 non isolated room. The

cleaning was done by fogging, which carried out in accordance with the Fogging Operational Procedure Standard of Universitas Gadjah Mada Academic Hospital. The result of this step are presented on Table 2.

This step's results show that the germ's number on the airs, floors, and walls of both the isolated and non isolated room after cleaning were met the requirements of Ministry of Health Decree 1204/MenKes/SK/X/2004 about Environmental Health Requirements in Hospital.

**Table 2.** Number of Germs after Cleaning with Fogging using IKM/5.4.6.M/BLK Method

Kind of sample/ Sample code	Location	Germ's Number	
		Result	Standard
Air/ 020596	Bima 3-307	50 cfu/m <sup>3</sup>	200 cfu/m <sup>3</sup>
Floor/ 020597	Bima 3-307	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>
Walls/ 020598	Bima 3-307	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>
Air/ 023777	Gatokaca 3-303	30 cfu/m <sup>3</sup>	200 - 500 cfu/m <sup>3</sup>
Floors/ 023778	Gatokaca 3-303	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>
Walls/ 020601	Gatokaca 3-303	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>

c. Step 3 (Cleaning using Ammonium Chloride).

This step was carried out on 7th October 2017 in Bima 3-307 as the isolated room and Gatokaca 3-

303 as the unisolated one. Cleaning was done using Ammonium Chloride, which is the derivative of Chlorine. Table 3 shows the result of this step.

**Table 3.** Number of Germs after Cleaning with Ammonium Chloride using IKM/5.4.6.M/BLK Method

Kind of sample/ Sample code	Location	Germ's Number	
		Result	Standard
Air/ 020596	Bima 3-307	178 cfu/m <sup>3</sup>	200 cfu/m <sup>3</sup>
Floors/ 020597	Bima 3-307	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>
Walls/ 020598	Bima 3-307	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>
Air/ 023777	Gatokaca 3-303	104 cfu/m <sup>3</sup>	200 - 500 cfu/m <sup>3</sup>
Floors/ 023778	Gatokaca 3-303	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>
Walls/ 020601	Gatokaca 3-303	0 – 1 cfu/cm <sup>2</sup>	0 – 5 cfu/cm <sup>2</sup>

Based on this step, The highest germ number is in Bima 3-307's airs, which is 178 cfu/m<sup>3</sup>. The germ number on Gatokaca 3 and Bima 3's airs, walls, and floors after cleaning with Ammonium Chloride were met the requirements of Ministry of Health Decree 1204/MenKes/SK/X/2004 about Environmental Health Requirements in Hospital. The highest one is in Bima 3-307's airs, which is 178 cfu/m<sup>3</sup>. Various air infections in vulnerable areas can be caused by exposure to microorganisms that are clinically released into the air when environmental conditions (eg soil, water, dust, and decomposed organic matter) are in bad

condition. In the room, microorganisms multiplied in the patient's bed, curtains, floor, walls, and in the patient itself. Furthermore, these microorganisms spread through the air and become a source of infection at these health facilities.

There are 3 methods that used on this research, which are cleaning using chlorine, fogging, and using ammonium chloride. Apart from the number of germs after cleaning, cleaning time also a consideration. The time spent until the room is ready for use can be seen on table 4.

**Table 4.** The time spent until the room is ready to use

The time spent until the room is ready to use		
Fogging	Chlorin	Amonium Chloride
7 hours	1 hour	1 hour

The result shows that fogging cleaning results in the lowest number of germs because it use an aerosol mechanism so that it can be more effective in the air. But there are many things that had to be considered in the use of fogging. Some substances on fogging substrate may contain propanolol and ethanol which have some negative impacts on human's body. These substances could cause a carcinogenic effects when inhaled and went to the lungs<sup>6</sup>. According to Ministry of Health Decree 27/ 2017 about Guidelines for Infection Prevention and Control, fogging is not a recommended method for room cleaning<sup>7</sup>.

Meanwhile, the air in the isolation room is still within the standard quality range after being fogged and cleaned with ammonium chloride. Cleansing with chlorine produces a germ number above the quality standard. Ammonium chloride and chlorine work as an antiseptic substances by rubbing them directly onto the surfaces of the objects. This is safer because these substances wouldn't mix with room's air directly. Compared to chlorine, ammonium chloride work more effective because the number of germs produced is lower than using chlorine. Ammonium Chloride has smaller corrosive effects so that it can be considered as a recommended antiseptic in cleaning the room<sup>5</sup>.

### Conclusions

Based on all treatments in this study, it can be concluded that both fogging and Ammonium Chloride – cleaning are effective methods in reducing the number of airborne germs in the isolation rooms (within the range of quality standards). Meanwhile, for the non isolated room and the isolated one, all of the treatments are effective in reducing the number of germs located on the walls and floors. Further research about this topic should be carried out in order to be able to calculate the type of germ number to obtain qualitative germ data. Further research also can be carried out in the Central Surgical Installation or Operating Room that has High Efficiency Particulate Air (HEPA) as an Air Purifier so the control of germ numbers can be optimized.

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